AGROSTIS AVENACEA (POACEAE: POOIDEAE): FIRST RECORD FOR THE MEXICAN FLORA

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ABSTRACT

Agrostis avenacea J.F. Gmel. is reported from temporary and permanent ponds of the region of Huimilpan and Amealco of the state of Queretaro, Mexico. Previously, it was only known from Australia, south Africa, Argentina, Chile, United State of America, the Hawaiian Islands and recently from Costa Rica. Diagnostic morphological and anatomical characters and illustrations are provided, and collection data and voucher specimens are cited.

RESUMEN

Agrostis avenacea J.F. Gmel. se cita de charcos temporales y permanentes de la región de Huimilpan y Amealco en el estado de Querétaro, México. Anteriormente sólo se conocía de Australia, sur de África, Argentina, Chile, Estados Unidos de América, Islas Hawai y recientemente de Costa Rica. Se proporcionan caracteres morfológicos y anatómicos diagnósticos e ilustraciones y se citan los datos de las colectas y especímenes examinados.

INTRODUCTION

Agrostis is a genus of grasses that was described by J.F. Gmelin in 1791. The genus is included in the Aveneae tribe and Alopecurinae subtribe (Pohl & Davidse 1994; Valdés-Reyna & Dávila-Aranda 1995). As presently circumscribed, the genus includes about 125–220 species (Acosta-Castellanos 1990; Beetle 1983; Clayton & Renvoize 1986; McVaugh 1983; Watson & Dallwitz 1992) which grow in temperate and cold regions from both hemispheres. In the tropics, they are mostly restricted to the high altitude mountains. Currently, the most recent list of species for Mexico (Espejo-Serna et al. 2000) shows that 23 species are registered for Mexico. While conducting an aquatic flora project of the Queretaro state Mahinda Martínez made a collection of subaquatic grasses from the Huimilpan and Amealco municipalities that proved to be *Agrostis avenacea* J.F. Gmel. This collection represents the first record of *A. avenacea* from Mexico and increases the number of species to 24.

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Agrostis avenacea J.F. Gmel., Syst. Nat. 2(1):171. 1791. *Calamagrostis avenacea* (J.F. Gmel.) Bech., Candollea 7:519. 1938. *Lachnagrostis avenacea* (J.F. Gmel.) Veldkamp, Blumea 37:230. 1992.

Agrostis debilis Poir, Encycl. Suppl. 1:249. 1810. *Vilfa debilis* (Poir.) P. Beauv., Ess. Agrostogr. 16, 147, 181. 1812.

Agrostis forsteri Roem. ex Schult., Syst. Veg. 2:359. 1817.

Agrostis leonii Parodi, Rev. Argent. Agron. 29(1-2):19. 1962.

Agrostis ligulata Steud., Syn. Pl. Glumac. 1:173. 1854.

Agrostis retrofracta Willd. Enum. Pl. 1:94. 1809. *Lachnagrostis retrofracta* (Willd.) Trin. Fund. Agrost. 128, 1820. *Vilfa retrofracta* (Willd.) P. Beauv. Ess. Agrostogr. 16, 148, 182. 1812. *Deyeuxia retrofracta* (Willd.) Kunth, Rev. Gramin. 1:77. 1829. *Calamagrostis retrofracta* (Willd.) Link, Hortus Berol. 2:247. 1833.

Avena filiformis G. Forst. Fl. Ins. Aust. Prodr. 9. 1786. *Agrostis filiformis* (G. Forst.) Spreng., Prim. Fl. Hal. 32, 1807. *Lachnagrostis filiformis* (G. Forst.) Trin., Fund. Agrost. 128, t. 10, 1820. *Calamagrostis filiformis* (G. Forst.) Rept. Bot. Surv. Tongariro Natt. Park 35, 1908. *Deyeuxia filiformis* (G. Forst.) Petrie, Subantartic Isl. 2:474. 1909.

Deyeuxia forsteri Kunth, Revis. Gramin. 1:77. 1829.

Lachnagrostis willdenowii Trin., Gram. Unifl. Sesguifl. 217. 1824. *Calamagrostis willdenowii* (Trin.) Steud., Syn. Pl. Glumac. 1:192. 1854.

Plants annual, cespitose. Culms erect, thin, breakable, 20–60 cm tall, 1–2 mm broad. Leaf blade flat, 5–20 cm long, 1–3 mm broad. Ligule 2–5 mm long. Panicle open, lax, 15–30 cm long; branches thin, slender, inferiors as longer as inflorescence axis, spikelets on the tips of the branches. Glumes acute, 2–5 mm long, 1-nerved, scabrous on the keel. Lemma membranous, pilose, 1.4–1.6 mm long, 5-nerved, with a mid-dorsal once-geniculate awn. Palea membranous, 1.1–1.3 mm long, nearly as long as lemma, 2-nerved, tip bifid, callus pubescent. Chromosome number: 2n = 28. (Fig. 1A–F)

Habitat.—*Agrostis avenacea* grows on dry to moist soils, with abundant clay and from 15 to 2350 m in elevation. In Mexico, it is grows around small streams, temporary and permanent ponds, and at sites at 2280–2350 m in elevation. it is found as a member of the subaquatic vegetation (Fig 2B).

Distribution.—This species is native to Australia (Canberra, New South Wales, Queensland and Tasmania) and New Zealand. In the Missouri Botanical Garden's herbarium and VAST nomenclatural database (W^3 TROPICOS) (www.mobot.org), there are records of its introduction in South Africa, Argentina (Buenos Aires, depression of El Salado, Entre Ríos and Santa Fé) and Chile (Isla de Pascua) (Nicora & Rugolo 1987), as well as, some temperate regions of the United States of America (California, Texas and Ohio), and the Hawaiian Islands (Hawaii, Kauai, Molokai, Oahu) (Hitchcock 1950). Recently, it was recorded from San José, Costa Rica (Davidse 1998). In Australia, it is an abundant weed of inundated places (Vickery 1941). Nicora and Rugolo (1987) and Zuloaga et al. (1994) recognize this taxon in the segregate genus *Lachnagrostis*.

In Mexico, *Agrostis avenacea* was collected from the municipalities of Huimilpan and Amealco, in the southern portion of the state of Queretaro (Fig.

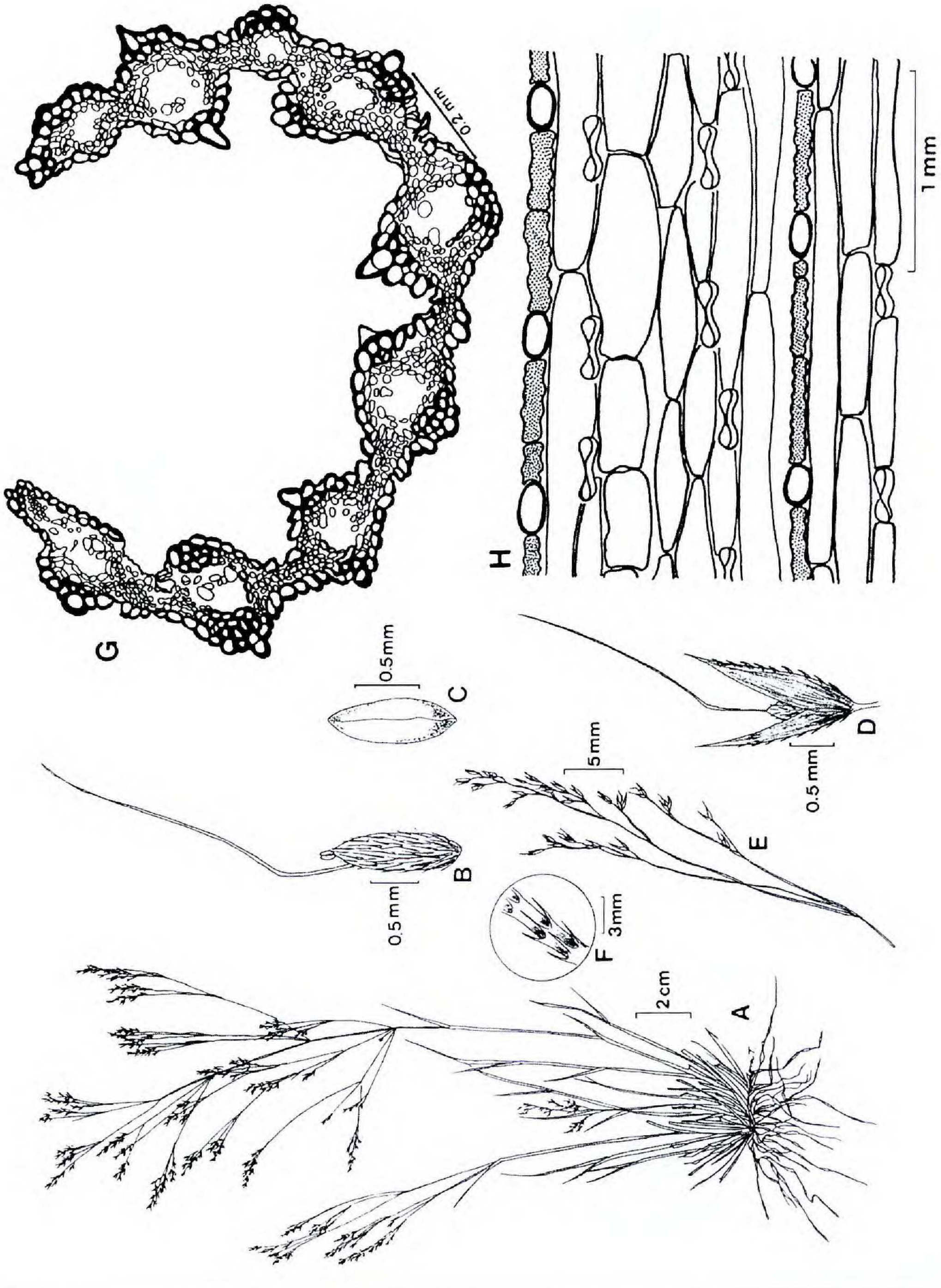


FIG. 1. *Agrostis avenacea* J.F. Gmel. (*M. Martínez 2936*, QMEX). A. Habit. B. Floret. C. Caryopsis. D. Spikelet. E. Inflorescence branches. F. Indument of inflorescence branches. G–H. Leaf blade anatomy. G. Detail of transverse section (*M. Martínez 2936*, QMEX). H. Abaxial epidermis as seen in surface view (*M. Martínez 2953*, QMEX). Stippling indicates the costal region in H.

2A). This species has not been previously reported in any floristic study from Mexico. This taxon was introduced to U.S.A (Hitchcock 1950; Davidse et al. 1998). In California and texas, plants of *A. avenacea* act like tumble weeds and its dried panicles are carried widely by wind and in the process dispersing seeds. It is unknown whether the populations of *A. avenacea* from Mexico is the result of long-range wind dispersion, or by some other manner, such as by vehicles passing through wetlands and picking up spikelets and panicles. It is probable that this taxon is growing in other states of Northern Mexico, as well.

Specimens examined: **MÉXICO: Querétaro:** Mpio. Huimilpan, arroyo La Beata, km 42 carretera Querétaro-Amealco-La Beata, 20° 21' LN y 100° 13' LW, 2350 msnm, 15 May 1996, *Martínez* 2936. Mpio. Huimilpan, "La Calle," km 33 Carretera Querétaro-Amealco, hacia las afueras de Huimilpan, 20° 22.5' LN, 100° 16.5' LW, 2280 msnm, 15 May 1996, *Martínez* 2952, 2953, 2955; Mpio. Amealco, km 31 carretera Amealco-San Juan del Río, 2 km al E de Amealco, charco permanente a la orilla de la carretera, 20° 12.84' LN, 100° 9.16' LW, 2490 msnm, 25 Jul 1996, *Martínez* 3331, 3333; Mpio. Amealco, km 5 carretera Amealco-San Ildelfonso, charco temporal, 20° 10.80' LN, 100° 5.40' LW, 2640 msnm, 5 Nov 1996, *Martínez* 3667 (QMEX, duplicates for distribution to IEB and MEXU).

Agrostis avenacea is distinguished by its slender, thin and lax inflorescences. The spikelets of mature inflorescences are easily dispersed by the wind.

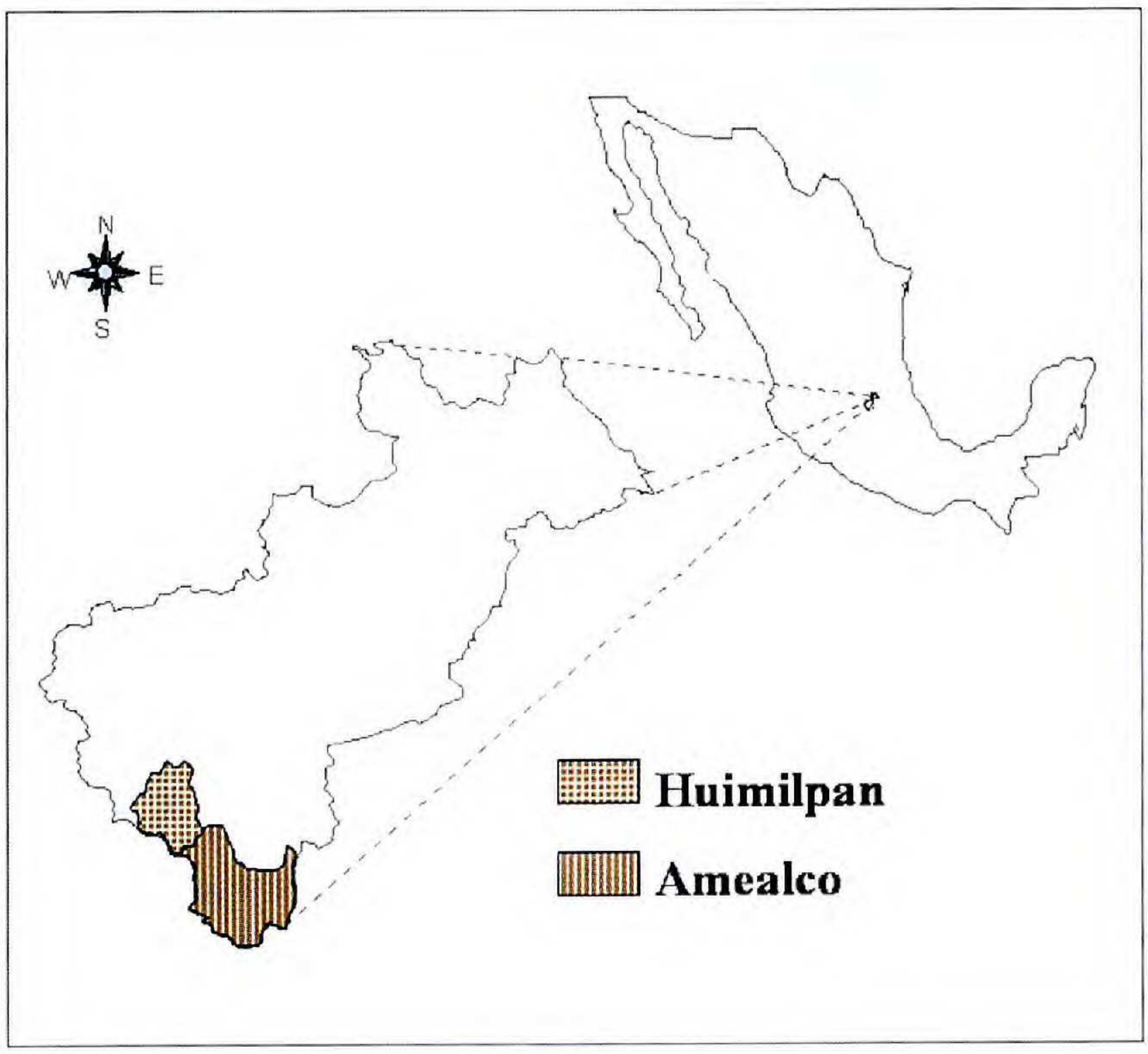
Leaf blade anatomy

The abaxial epidermis and inner structure of the leaf blade were studied. The epidermis and transverse sections were obtained following Gomez-Sánchez and Koch (1998).

Abaxial epidermis.—Differentiation of the costal and intercostal zones inconspicuous. Long cells, fusiform, longer than wide. Stomata abundant, 37–39 μm long, parallel-sided subsidiary cells, guard cells hidden by interstomatal long cells. Papillae absent. Prickles a few in the costal zone. Silica bodies, microhairs and macrohairs absent (Fig. 1H).

Transverse section.—Outline of the blade U-shaped, nodular. Abaxial and adaxial surface with rounded ribs associated with all vascular bundles; abaxial and adaxial furrows broad and deep. Vascular bundles nine; usually first order vascular bundles. Outer vascular bundle sheaths absent. Sclerenchyma costal strands present, the abaxial in 2–4 cells wide and 1–2 cells tall, the adaxial in 1–3 cells wide and 1–2 cells tall or absent. Chlorenchyma nonradiate, its cells of various sizes and shapes, continuous between adjacent vascular bundles. Colorless parenchyma cells absent. Bulliform cells in fan-shaped, adaxial groups no conspicuous, central cell relatively small, or absent (Fig. 1G).

Agrostis avenacea is clearly a member of the Pooideae in its anatomical features. It is a Non-Kranz species, with C_3 photosynthetic metabolism (Hattersley & Watson 1975). It has a typical "pooid" anatomy, characteristic of those species that grow in temperate climates. The leaf blade is nodular with ribs and deep furrows in the abaxial and adaxial surfaces. The limited development of



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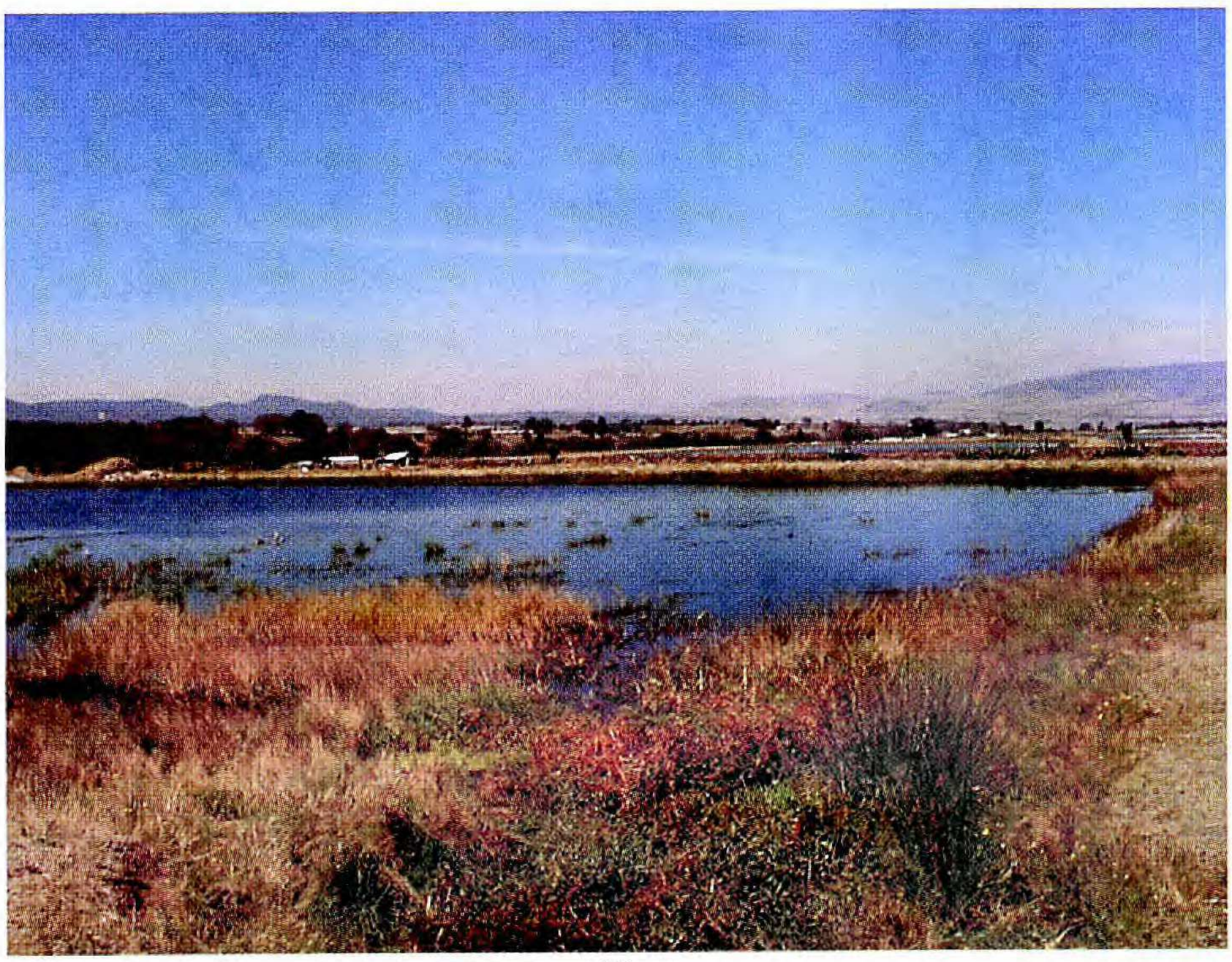

B

FIG. 2. Region of Mexico where *Agrostis avenacea* was colected. 2A. Map showing Municipalities of Amealco and Huimilpan of the State of Querétaro, Mexico. 2B. Temporary pond in the Municipality of Amealco in the Satate of Queretaro.

abaxial and adaxial sclerenchyma explains the presence of the breakable and lax culms and suggests that *Agrostis avenacea* is adapted to wet habitats.

Several taxonomic treatments of *Agrostis* exist (Acosta-Castellanos 1990; Pohl 1980; Pohl & Davidse 1994; Davidse 1998), however these treatments are partial and taxonomic affinities of the species are uncertain. The genus *Agrostis* urgently needs a world revision (Pohl & Davidse 1994; Davidse 1998). In addition to the morphological, anatomical, micromorphological work, the development of molecular studies will be a very important contribution to circumscription of *Agrostis* species.

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REFERENCES

Acosta-Castellanos, S. 2001. *Agrostis*. In: Rzedowski, J. and Graciela C. de Rzedowski, eds. Flora Fanerogámica del Valle de México. Instituto de Ecología, Centro Regional del Bajío. Pátzcuaro, Mich. México. Pp. 1014–1017.

Beettle, A.A. 1983. Las gramíneas de México. Secretaría de Agricultura y Recursos Hidráulicos- COTECOCA. México.

Clayton, W.D. and S.A. Renvoize. 1986. Genera graminum. Grasses of the World. Kew Bull., Add. Ser. 13. London.

Davidse, G. 1998. *Agrostis*. In: G. Davidse, M. Sousa S., and S. Knapp, eds. Flora Mesoamericana. Versión Internet (W^3FM). Universidad Nacional Autónoma de México. México.

Espejo-Serna, A., A.R. López-Ferrari, and J. Valdés-Reyna. 2000. Poaceae. In: Espejo-Serna A. and A.R. López-Ferrari, eds. Las Monocotiledóneas Mexicanas, una Sinópsis Florística. I. Lista de Refrencia. Parts IX–XI. Consejo Nacional de la Flora de México. Mexico. Pp. 8–14.

Gómez-Sánchez, M. and S.D. Koch. 1998. Estudio anatómico comparativo de la lámina foliar de *Eragrostis* (Poaceae: Chloridoideae) de México. Acta Bot. Mex. 43:33–56.

Hattersley, P.W. and L. Watson. 1975. Anatomical parameters for predicting photosynthetic pathways in grass leaves. Phytomorphology 25:325–333.

Hitchcock, A.S. and A. Chase. 1951. Manual of the grasses of the United States. U. S. Dept. of Agric., Misc. Publ. No. 200: 1051 pages (Second edition, revised by A. Chase)

McVaugh, R. 1983. Flora Novo-Galiciana. 14. Gramineae. University of Michigan Press. Ann Arbor. Missouri Botanical Garden: http://mobot.mobot.org/W3T/search/vast.html

Nicora, E.G. and Z.E. Rugolo de Agrasar. 1987. Los géneros de gramíneas de América Austral. Hemisferio Sur. Buenos Aires, Argentina.

Pohl, R.W. 1980. Flora Costaricensis. Family # 15. Gramineae. Fieldiana Bot. n.s. 14:1–607.

POHL, R.W. and G. DAVIDSE. 1994. *Agrostis*. In: Davidse, G., M. Sousa S. and A.O. Chater, eds. Flora Mesoamericana. Vol. 6. Universidad Nacional Autónoma de México. México. Pp. 237–240.

VALDÉS-REYNA, J. and P. DÁVILA-ARANDA. 1995. Clasificación de los géneros de gramíneas Mexicanas. Acta Bot. Mex. 33:37–50.

VICKERY, J.W. 1941. A revision of the Australian species of *Agrostis* L. Contr. N.S.W. Natl. Herb. 1:101–119.

WATSON, L. and M.J. DALLWITZ. 1992. The grass genera of the World. C.A.C. International. Wallingford.

ZULOAGA, F.O., E.G. NICORA, Z.E. RUGOLO DE AGRASAR, O. MORRONE, J. PENSIERO, and A.M. CIALDELLA. 1994. Catálogo de la Familia Poaceae en la República Argentina. Monogr. Syst. Bot. Missouri Bot. Gard. 47:1–178.